LOOK WHAT HAPPENED WHEN 3300 PEOPLE TRIED TO BREAK A LEXAN® LENS

POLYCARBONATE RESIN

this was the offer...

WANT A ROBERTSON REWARD?

1—Just break (solely by mechanical means) the transparent red LEXAN housing lens

2—Send the pieces to J. W. Robertson, G-E plastics specialist for the automotive industry

and 3—receive a G-E Penline 120 soldering iron

IF THIS PROVES MORE DIFFICULT THAN YOU THINK (it will), but you succeed anyway (nothing is impossible), you may want to try for a bigger prize. We'll give a $50 U.S. Savings Bond for the most ingenious, dramatic or impressive method of breaking the housing. $25 bonds will go to the two best runner-up methods. Just detail your procedure in a note to Jim when you send in the pieces.

CAUTION: Housings must be broken by mechanical means only. While certain chemical agents will damage the resin, their use is against contest rules and can be detected readily. Entries should be postmarked not later than February 2, 1963.

Don't discard this just because you know or find out how tough a LEXAN part can be. There are other things you can send Jim Robertson. Such as your present or future design problems which G-E phenolics or polycarbonates may help solve. Jim, our automotive industry specialist, is well prepared to give you design and processing assistance. And if he can't tackle your problem personally, he'll see your request is handled promptly by the C.M.D. engineer best equipped to help you.

The address, for problems and submittals for Robertson Rewards,

James W. Robertson,
CHEMICAL MATERIALS DEPARTMENT
General Electric Company
21590 Greenfield Road,
Oak Park 37, Mich.
Tel. 548-6005

The LEXAN test piece is identical to the housing-lens on the driveless **Hubodometer** of Engler Instrument Company. It was molded of LEXAN 101-611 by Polymid Plastics Products Co., Linwood, Michigan.

this was the LEXAN lens...

Diameter: 4.875 in.; Height: 1.125 in.; Thickness: 0.100 in.

and these were the ingenious, persistent tortures the

"Well, we bent it . . . but, WE COULDN'T BREAK IT! After trying to break the lens with a hand hammer, running it over with a truck, putting it on a 5,000 lb. hammer, we placed it under the 20,000 lb. hammer, and, by George, we flattened it. Here's the proof."

A. D. F., Manager of Public Relations

"Seeing that it was useless trying to break the housing with a hammer, I tried putting it in a vise and applying pressure. The result was a neat bend without any breaks. I remembered an experiment using a Tinius Olson Tensile Testing Machine. The test was successful in breaking the housing. I might add that the load reached 2700 lbs. before it (LEXAN) started to fail."

E. J.

"The following procedure was used in accomplishing this task: 1-Bend by hand, 2-Hit with hammer, 3-Jump on it, 4-Get mad, 5-Place under 5000 lb. Blacksmith Steam Hammer, 6-Raise ram to top of stroke, 7-Apply full head of steam, 8-Remove pancake-shaped LEXAN lens, 9-Notice that it did not break, 10-Turn to hand bending method and fatigue the super plastic to breakage, 11-Smile, for I have accomplished what two fellow students failed to do with heat, cold and impact."

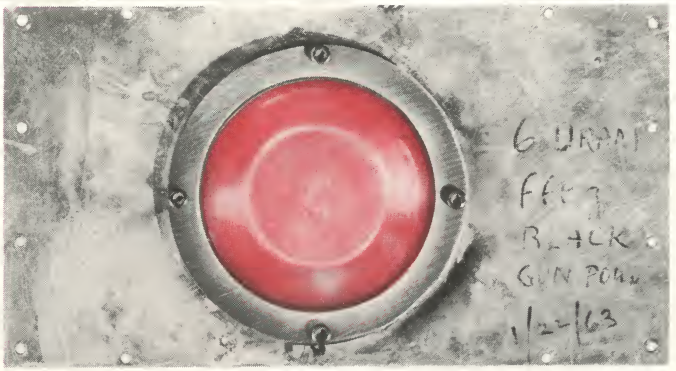
P. M. W.

"The LEXAN nearly won. But then I submerged the housing in liquid nitrogen (about −200°C.) for five minutes, placed it on the floor and struck it mightily with a hammer: on the first blow the hammer merely bounced; on the second more vigorous blow, the hammer went through with a loud report, scattering pieces of LEXAN into the cheering multitude gathered to watch the titanic battle between man and LEXAN."

D. B. B.

"I tried a hammer and sledge hammer, but merely dented it a little. Also tried a 100-ton press on it, it gave some but didn't break. I then put it under a 200-ton press and broke it with that."

P. Z.



"Calling in my three boys, I offered 50 cents to the first one to break the 'little plastic dish'. After an hour of the most terrifying pounding they returned with it. I was a little awed, here were three demolition experts stumped by a little plastic dish. There was only one thing left to do . . . blast! We drilled a small hole in the aluminum back plate of the 'test fixture' to accept a 6″ fire cracker fuse. Inside the lens was placed 6 grams of black gun powder (the equivalent charge of both barrels of a shotgun) and the lens was clamped to the plate with a half-inch thick steel ring. The fuse was lit and all warned to watch for the little pieces of plastic when she blew. The results were unbelievable! The LEXAN didn't budge a bit, but the plate was badly bulged out of shape. I'm impressed."

R. M.

winners* applied in their homes, shops and laboratories!

"Enclosed is broken LEXAN housing—lens. Broken by one of the oldest means of producing kinetic energy—a bow and arrow. Pull weight of bow—47 pounds; approximate energy—39 foot pounds. The round holes resulted from a field point. The large piece completely broke away on the third hit from the enclosed broadhead. The shaft was Port Orford cedar."

P. H., Design Engineer

"Method: This lens was clamped in a vise and then subjected to about 45 minutes of intense punishment with a hammer. It finally broke! You proved your point though—it is the toughest plastic I have ever seen—great possibilities!"

J. S.

"After hammering, squeezing in a vise, jumping on it, running over with an automobile, etc., I lowered the temperature by packing with dry ice and dropped a vise on it. That didn't work either. For my final effort, I worked out an arrangement with a crane operator whose crane was equipped with a metal ball. I filled the LEXAN part with alcohol, melted dry ice in the alcohol, lowering its temperature to an estimated −60°C., and covered the part with a board. The operator raised the huge ball to the top and released it. Enclosed please find the pieces."

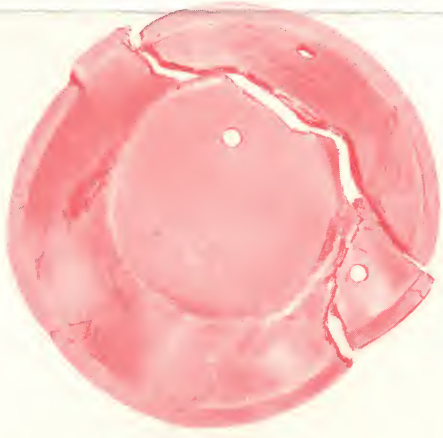
W. J. K., Chief of Special Projects

"No question about it! LEXAN is tough. In our shop we tried the following and did not break it: 1. A 200 lb. man jumped on it, 2. Dropped a 10-ton capacity hydraulic floor jack on it, 3. Drove a truck over it, 4. Squeezed it in a 6" bench vise, 5. Squeezed it with a 60" hydraulic press. At home the following procedures also failed: 1. My three children tried, 2. Drove a car over it trying to fold it. I finally broke it by folding it in a vise and then opening the fold by hammering it on the concrete floor with a 20 lb. sledge hammer."

J. L. R., Assistant Vice President

"I worked on this lens for 3 weeks straight, a little bit every day, until it broke. A most amazing material."

G. L. H.



"Broken by the unwitting courtesy of the Long Island Railroad. Thank you."

F. K. G., Automotive Consultant

* Of the 3300 contest pieces distributed by General Electric at the 1963 Society of Automotive Engineers Show, Detroit, only 110 were returned. Only 98 entrants—less than 3%—qualified for prizes.

Know of any engineering quality plastic which could have withstood such grueling punishment so well? Or of many materials of any type, much less transparent, dimensionally stable ones with this kind of ruggedness? If there is any doubt why we consider LEXAN the most versatile of the tough thermoplastics, check the values below. They are typical of all properly molded LEXAN polycarbonate resin parts.

Physical Properties

Property	Average Value	A.S.T.M. Test
Specific gravity	1.20	D792
Odor	None	—
Taste	None	—
Refractive index at 25 C	1.586	—
Rockwell hardness	M70	D785
Abrasion resistance, Taber abraser with CS-17 wheel	10 mg/1000 cycles	D1044
Impact strength, notched Izod, ⅛-inch specimen	16 ft-lb/in. of notch	D256
Impact strength, unnotched Izod, ⅛-inch specimen	> 60 ft-lb/in.	D256
Tensile-impact, 5 type specimen	225 ft-lb/in.^{2}	D1822
Tensile-yield strength	9,000 psi	D638
Tensile-ultimate strength	9,500 psi	D638
Tensile modulus	345,000 psi	D638
Elongation	110%	D638
Compressive strength	12,500 psi	D695
Compressive modulus	345,000 psi	D695
Flexural strength	13,500 psi	D790
Flexural modulus	340,000 psi	D695
Shear-yield strength	6,000 psi	D732
Shear-ultimate strength	10,000 psi	D732
Light transmission (⅛-inch thick disk)	85%	—
Water-vapor permeability	14.0 x 10^{-13} cm^3/STP/mm/sec/cm^2/cm Hg	—
Nitrogen permeability	3.0 x 10^{-10} cm^3/STP/mm/sec/cm^2/ cm Hg	—
Carbon dioxide permeability	80.0 x 10^{-10} cm^3/STP/mm/sec/cm^2/cm Hg	—
Bulk factor of pellets	1.7	—
Poisson's ratio	0.37	—
Modulus of rigidity	116,000 psi	—
Deformation under load, 4000 psi 77 F	0.2%	D621
158 F	0.3%	
Fatigue endurance limit (Krause method), 1800 cycles/min., 73 F, 50% RH	1.000 psi	
Water absorption, 24 hour immersion	0.15%	D570
equilibrium 73 F	0.35%	
equilibrium 212 F	0.58%	

Thermal Properties

Deflection temperature	264 psi: 270 F; 66 psi: 280 F	D648
Mold shrinkage	0.005—0.007 in./in.	D955
Thermal conductivity	4.6 x 10^{-4} cal/sec/cm^2/°C/cm 0.2255 BTU/sec/ft^2/°F/in	—
Coefficient of linear-thermal expansion	3.75 x 10^{-5}in/in/°F	
—30 C to 30 C	6.7 x 10^{-5}in/in/°C	D696
Flammability	Self-extinguishing	D635
Brittle temperature	< – 135 C	D746
Specific heat	0.30	

Electrical Properties

	—30 C	—3 C	23 C	100 C	125 C	
Dielectric constant						
60 cycles	3.12	3.14	3.17	3.15	3.13	D150
10^6 cycles			2.96			D150
Power Factor						
60 cycles	0.005	0.004	0.0009	0.0009	0.0011	D150
10^6 cycles			0.010			D150
Volume resistivity, ohm-cm	> 10^{17}	> 10^{17}	2.1 x 10^{16}	2.1 x 10^{15}	2.7 x 10^{14}	—
Arc resistance,						D495
stainless-steel strip electrodes			10—11 sec			
tungsten electrodes			120 sec			

	25 C	100 C	
Dielectric strength, short time	3,910 v./mil at 1.5 mils 3,080 v./mil at 3.0 mils 2,560 v./mil at 4.7 mils 1,130 v./mil at 23.0 mils 380av./mil at 125.0 mils	3,380 v./mil at 3.0 mils 1,250 v./mil at 23.0 mils 600av./mil at 125.0 mils (aThe step-by-step values are essentially the same as the short time values for the 125-mil pieces)	D149
Resistance to electron-beam radiation	No change up to 5 x 10^7r dosage		

For additional information about LEXAN — the most versatile of the tough thermoplastics — and samples of this amazing product for evaluation, write:

GENERAL ELECTRIC

Chemical Materials Department • One Plastics Avenue • Pittsfield, Mass. 01201

CDC-420A (20M-7/66)